CONTAINER HANDLING APPARATUS

FIELD OF THE INVENTION

This invention relates generally to material handling apparatuses, and more particularly to container handling apparatuses.

BACKGROUND OF THE INVENTION

The transportation of containers within a beverage bottling facility is a critical factor in the overall performance and efficiency of the beverage bottling facility. Typically, containers arrive at the bottling facility from an off-site location, and are loaded into a transportation system that is configured to route the containers through the bottling facility. The transportation system includes multiple conveyors arranged to deliver the containers to one or more filling stations that fill the containers with a beverage. Depending on the configuration of the transportation system, the containers may be re-directed one or more times from one conveyor to another. Special transfer conveyors are utilized to transfer the containers between conveyors.

The transfer conveyors typically include one or more gripping mechanisms that grasp the neck portions of the containers when transferring the containers from one conveyor to another. Such a gripping mechanism may include a conventional "scissors-type" pincer mechanism that is operable via mechanical linkages driven by a cam arrangement. During operation of such a gripping mechanism, the opening of the pincer mechanism coincides with or occurs shortly before the neck portion of the container arrives in position to be grasped by the pincer mechanism. The cam arrangement actuates the mechanical linkage

coupled to the pincer mechanism to control the opening and subsequent closing of the pincer mechanism. The transfer conveyor then re-directs the container toward another conveyor. Upon reaching the destination conveyor, the cam arrangement again actuates the mechanical linkage to release the container to the destination conveyor.

SUMMARY OF THE INVENTION

Conventional gripping mechanisms, like the scissors-type pincer mechanism described above, may have some drawbacks. For example, the cam arrangement and mechanical linkages normally associated with actuating the gripping mechanisms are often complex, and as a result, are typically relatively expensive to manufacture. In addition to the complexity, the shear number of components involved with actuating the gripping mechanisms may impact the robustness of the design. Also, the complexity and shear number of components involved with the gripping mechanisms may require significant amounts of time for cleaning the gripping mechanisms. Further, conventional gripping mechanisms may be difficult to remove from the transfer conveyor because of the complexity introduced by the cam arrangement and mechanical linkages responsible for actuating the gripping mechanisms. As a result, changing-out or replacing a damaged or non-functional gripping mechanism may require significant amounts of down-time.

The present invention provides a container handling apparatus configured to grip and support a container. The apparatus includes a support member configured to be coupled to a conveyor, and a one-piece retainer releasably coupled to the support member. The retainer is configured to engage a container.

In another aspect, the present invention provides the retainer having a first arm portion, a second arm portion, and a base portion interconnecting the first and second arm portions. Each of the arm portions includes a distal end, and the distal ends of the respective arm portions are spaced and configured to accept entry of the container such that the arm portions deflect away from one another as the container enters between the distal ends. Each of the arm portions also includes an arcuate portion to secure the container between the respective arcuate portions of the first and second arm portions.

In yet another aspect, the present invention provides a mounting member configured for releasably engaging the support member to couple the support member to the conveyor. The retainer is releasable from the support member only when the support member is disengaged from the mounting member. The support member is releasable from the mounting member without the use of tools, and the retainer is releasable from the support member without the use of tools.

The present invention also provides a method of re-conditioning a container handling apparatus including a support member configured to be coupled to a conveyor. The method includes coupling a first one-piece retainer to the support member, engaging and releasing a first container with the first retainer, uncoupling the first retainer from the support member, coupling a second one-piece retainer to the support member, and engaging and releasing a second container with the second retainer.

Further, the present invention provides a conveyor assembly including a conveyor, and a plurality of container handling assemblies coupled to the conveyor. Each of the container handling assemblies includes a mounting member coupled to the conveyor, a support member releasably engaged to the

mounting member, and a one-piece retainer releasably coupled to the support member. The retainer includes a first arm portion, a second arm portion, and a base portion interconnecting the first and second arm portions such that a container can be engaged and retained by the first and second arm portions. The retainer can be uncoupled from the support member without the use of tools upon disengagement of the support member from the mounting member.

Other features and aspects of the present invention will become apparent to those skilled in the art upon review of the following detailed description, claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, wherein like reference numerals indicate like parts:

Fig. 1 is a perspective view of multiple container handling apparatuses coupled to a conveyor.

Fig. 2 is an exploded perspective view of one of the container handling apparatuses of Fig. 1.

Fig. 3 is a top view of one of the container handling apparatuses of Fig. 1.

Fig. 4 is a section view of one of the container handling apparatuses of Fig. 1 taken along section line 4--4 in Fig. 3, illustrating an attached container.

Fig. 5 is a top view of a retainer of one of the container handling apparatuses of Fig. 1.

Fig. 6 is a top view of another construction of a container handling apparatus.

Fig. 7 is a section view of the container handling apparatus of Fig. 6 taken along section line 7--7 in Fig. 6.

Fig. 8 is a section view of the container handling apparatus of Fig. 6 taken along section line 7--7 in Fig. 6, illustrating an attached container.

Fig. 9 is a top view of another construction of a retainer adapted for use with the container handling apparatuses of Figs. 1 or 6.

Fig. 10 is a section view of the retainer of Fig. 9 taken along section line 10--10 in Fig. 9.

Before any features of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other constructions and of being practiced or being carried out in various ways. Also, it is understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items.

DETAILED DESCRIPTION

Fig. 1 illustrates multiple container handling apparatuses 10 coupled to a conveyor 14, which is schematically illustrated as a dashed line. The conveyor 14 may be any of a number of different types or designs, and may be configured to transport items in any of a number of different paths. Also, the conveyor 14 may also be a transfer conveyor, such as a rotatable platform configured to transfer the items from one conveyor to another conveyor.

In the illustrated construction of Figs. 1-5, each handling apparatus 10 is configured to handle a plastic bottle 18. Such a bottle 18 includes a narrowed

portion defining in part a neck portion 22 of the bottle 18. Adjacent the neck portion 22 at an open end of the bottle 18 is a threaded finish 26, which may receive a cap (not shown) having matching threads to close the open end of the bottle 18. As shown in FIG. 4, a collar 30 is formed on the neck portion 22 of the bottle 18. In some constructions of the bottle 18, the collar 30 may provide a stop as to how far the cap may be threaded onto the threaded finish 26. However, other constructions of the bottle 18 may not include the collar 30 and/or the threaded finish 26.

The bottle 18 may be made of a polyethyleneterephthalate (PET) plastic material, or any other suitable plastic material. However, the bottle 18 may also be made from a different material, such as glass. Further, the container handling apparatus 10 may be configured to handle other items having a narrowed portion similar to the neck portion 22 of the bottle 18.

As shown in Figs. 1 and 2, the handling apparatus 10 includes a support member 34 coupled to the conveyor 14 and a one-piece, resilient retainer 38 releasably coupled to the support member 34. The retainer 38 is configured to resiliently engage and retain the bottle 18 to the handling apparatus 10 for transport. As shown in Figs. 1-3 and 5, the retainer 38 includes a first arm portion 42, a second arm portion 46, and a base portion 50 interconnecting the first and second arm portions 42, 46, whereby the bottle 18 is retained between the first and second arm portions 42, 46. The configuration of the retainer 38 provides an inward bias of the first and second arm portions 42, 46 when the first and second arm portions 42, 46 are deflected away from each other.

The material properties of the retainer 38 determine the extent of the inward bias, or the resilience of the retainer 38. In the illustrated construction, the

retainer 38 is made from a spring steel material (e.g., 302 STST). However, the retainer 38 may be made from other materials that are capable of providing a sufficient inward bias or resiliency of the first and second arm portions 42, 46 for a particular bottle-handling application. In addition, the retainer 38 is shown (see Fig. 4) having a circular cross-section. However, the retainer 38 may be configured with any of a number of different cross-sections (e.g., square, rectangular, triangular, and so forth). In some aspects of the present invention, a retainer 38 having a cross-section with at least one flat surface in abutment with the bottle 18 may be preferable to provide a more stable grip on the bottle 18.

As shown in Figs. 3 and 5, the first and second arm portions 42, 46 of the retainer 38 include respective distal ends 54 configured to accept entry of the neck portion 22 between the first and second arm portions 42, 46. The respective distal ends 54 of the first and second arm portions 42, 46 are outwardly splayed such that they define therebetween an angle θ of about 80°. However, in other constructions of the retainer 38, the angle θ may be as low as about 70°.

With continued reference to Figs. 3 and 5, the first and second arm portions 42, 46 also each include an arcuate portion 58 adjacent the respective outwardly-splayed distal ends 54, whereby the neck portion 22 of the bottle 18 is securable between the respective arcuate portions 58 of the first and second arms 42, 46. More particularly, the arcuate portions 58 each include a forward portion 62, a middle portion 66, and a rear portion 70. The forward portion 62 acts as a transition from the distal end 54 to the middle portion 66, while the middle portion 66 retains the neck portion 22 during transport of the bottle 18, and the rear portion 70 acts as a stop against which the neck portion 22 may not move past.

After the neck portion 22 initially passes the respective distal ends 54 of the first and second arm portions 42, 46, the forward portions 62 cause the first and second arm portions 42, 46 to deflect away from each another in response to the insertion of the neck portion 22 into the retainer 38. In the illustrated construction of Figs. 3 and 5, the forward portions 62 each define a shape having a radius to provide the bottle 18 a smooth transition into engagement with the middle portions 66. The radii of the respective forward portions 62 also provide the bottle 18 a smooth transition out of engagement with the middle portions 66 when the bottle 18 is released from the retainer 38. However, in other constructions of the retainer 38, the forward portions 62 may define any of a number of shapes (e.g., a sharp edge or a compound curve, among others) that provide the bottle 18 a smooth transition into and out of engagement with the middle portions 66.

In addition, a clearance dimension D_1 between the respective forward portions 62 of about 66% of the diameter of the neck portion 22 exists to allow the neck portion 22 to be engaged by the retainer 38 with an amount of resistance to engagement. The clearance dimension D_1 is also sized to provide an amount of resistance to disengaging or removing the bottle 18 from the retainer 38, such that unintentional disengagement or removal of the bottle 18 from the retainer 38 is substantially prevented. The clearance dimension D_1 may be varied to affect the retainer's resistance to engagement or disengagement with the bottle 18. The clearance dimension D_1 may be as small as about 63% of the diameter of the neck portion 22, or as large as about 71% of the diameter of the neck portion 22.

As the neck portion 22 passes the respective forward portions 62 of the first and second arm portions 42, 46, the inward bias of the first and second arm

portions 42, 46 causes them to return to their undeflected positions, thereby securing the neck portion 22 between the respective middle portions 66. In the illustrated construction of Figs. 3 and 5, the middle portions 66 each define a shape having a radius to grasp or retain the neck portion 22 therebetween. Further, the retainer 38 may be configured in any of a number of different sizes to retain bottles 18 of different sizes. More particularly, the respective middle portions 66 of the first and second arm portions 42, 46 may be suitably shaped to snugly receive bottles 18 having a particular neck portion 22 diameter.

The first and second arm portions 42, 46 also each include rear portions 70 adjacent the respective middle portions 66. In the illustrated construction of Figs. 3 and 5, the rear portions 70 each define a shape having a radius. However, in other constructions of the retainer 38, the rear portions 70 may define any of a number of shapes (e.g., a sharp edge or a compound curve, among others). In addition, a clearance dimension D_2 between the respective rear portions 70 of about 49% of the diameter of the neck portion 22 exists to substantially prevent the neck portion 22 from being further inserted past the middle portions 66. The clearance dimension D_2 may be varied to as small as about 47% of the diameter of the neck portion 22 , or as large as about 51% of the diameter of the neck portion 22.

With continued reference to Figs. 3 and 5, the first and second arm portions 42, 46 also each include intermediate portions 74 adjacent the respective rear portions 70. The intermediate portions 74 are substantially straight, and connect with the base portion 50 via respective blend radii 78. In the illustrated construction, the intermediate portions 74 define therebetween an angle σ of about 60°. However, in other constructions of the retainer 38, the angle σ may be as

high as about 65°. Also, in the illustrated construction, the blend radii 78 each define a radius. However, in other constructions of the retainer 38, the blend radii 78 may define any of a number of shapes (e.g., a sharp edge or a compound curve, among others).

In the illustrated construction, the retainer 38 is symmetrical about a longitudinal axis 82 extending in a direction normal to the base portion 50, such that the first and second arm portions 42, 46 are substantially identical. However, in other constructions of the retainer 38, the retainer 38 may be asymmetrical about the longitudinal axis 82, such that the distal ends 54 or the arcuate portions 58 of the respective first and second arm portions 42, 46 are configured and/or shaped differently. For example, the first arm portion 42 may define an arcuate portion shaped to grasp more of the neck portion 22 than the arcuate portion of the second arm portion 46.

With reference to Fig. 2, the retainer 38 is shown de-coupled from the support member 34. The support member 34 generally includes spaced apart projections 86 coupled to a plate-like or planar body 88. As shown in Fig. 2, the projections 86 are configured as generally cylindrical bodies, with each projection 86 defining a groove 90 around its perimeter. However, in other constructions of the support member 34, the projections 86 may be configured in any of a number of different shapes that at least partially capture the retainer 38 therebetween. In addition, other constructions of the support member 34 may include projections 86 with each having a groove or notch only over a portion of its perimeter rather than over its entire perimeter.

The projections 86 are spaced an appropriate distance apart so the retainer 38 may be releasably coupled thereto. In addition, the projections 86 are spaced

an appropriate distance apart to act as a fulcrum to the movement of the first and second arm portions 42, 46 in a direction substantially normal to the longitudinal axis 82. As shown in Figs. 3 and 4, the intermediate portions 74 of the retainer 38 are shown positioned in the respective grooves 90 of the projections 86. To couple the retainer 38 and the support member 34, the retainer 38 should be inserted between the projections 86 such that the distal ends 54 pass between the projections 86 before the intermediate portions 74 are received in the respective grooves 90, at which time the retainer 38 is at least partially secured to or captured by the support member 34.

The support member 34 also defines a recess 94 to receive a portion of the bottle 18. More particularly, the recess 94 is substantially defined by a radius sized to receive the neck portion 22 of the bottle 18. As shown in Fig. 3, the radius of the recess 94 substantially correlates with the radii of the respective middle portions 66 of the first and second arm portions 42, 46 when the retainer 38 is coupled to the support member 34. However, in other constructions of the support member 34, the recess 94 may be defined by any of a number of different shapes, provided at least a portion of the bottle 18 may be received therein. Also, as shown in Fig. 3, the recess 94 is partially defined by guide surfaces 98 that help guide the neck portion 22 of the bottle 18 into the recess 94.

With reference to Fig. 4, the neck portion 22 of the bottle 18 is engaged both by the retainer 38 and the support member 34. The support member 34 engages the neck portion 22 at a location below the collar 30, while the retainer 38 engages the neck portion 22 at a location above the collar 30. Therefore, the support member 34 supports the weight of the bottle 18 when the neck portion 22 is received by the recess 94 and the collar 30 is abutted with the top surface of the

body 88, and the retainer 38 prevents the neck portion 22 from disengaging the recess 94.

With continued reference to Fig. 4, and additionally to Figs. 1-3, the support member 34 is releasably coupled to the conveyor 14 via a mounting member 102. The mounting member 102 is adapted to be coupled to a fixture 106 on the conveyor 14, which may take any of a number of different forms and/or configurations. In the illustrated construction, the fixture 106 is configured as a rectangular upright. The mounting member 102 includes a stepped aperture 110 extending therethrough, whereby a conventional threaded fastener 114 is inserted to fasten the mounting member 102 to the fixture 106. The mounting member 102 also includes a lip 118 engageable with the fixture 106 to substantially prevent rotation of the mounting member 102, support member 34, and the retainer 38 about the fixture 106.

The mounting member 102 further includes a slot 122 sized to receive therein the body 88 of the support member 34. In the illustrated construction, the rear edge of the support member 34 is received in the slot 122. Further, the mounting member 102 includes a button 126 upwardly extending through an aperture 130 in the mounting member 102. The button 126 is biased upwardly by a compression spring 134, which is maintained in position by a perch 138 coupled to the fixture 106. In its extended position, the button 126 is engageable with the support member 34 via an aperture 142 in the support member 34 (see Fig. 4). To release the support member 34 from the mounting member 102, the button 126 must be depressed before pulling the support member 34 from the slot 122 of the mounting member 102.

When the support member 34 is secured to the mounting member 102 by the button 126, the retainer 38 is fully secured to or captured by the support member 34, since the intermediate portions 74 are abutted against the projections 86 and the base portion 50 is abutted against the mounting member 102. The abutment of the base portion 50 with the mounting member 102 biases the intermediate portions 74 against the projections 86. The abutment further prevents rotation of the retainer 38 with respect to the support member 34 and the mounting member 102. As a result, the retainer 38 is prevented from being removed from the support member 34 while the support member 34 is coupled to the mounting member 102.

With reference to Figs. 1-5, the retainer 38, the support member 34, and the mounting member 102 are configured such that no tools are required to couple or de-couple the support member 34, the mounting member 102, and the retainer 38. This aspect of the container handling apparatus 10 allows for, among other benefits, a decreased amount of downtime while reconditioning or reconfiguring the handling apparatuses 10. One or more of the handling apparatuses 10 may be re-conditioned, for example, when a damaged or dirty retainer 38 is replaced by a new retainer 38. Further, the handling apparatuses 10 may be reconfigured, for example, when retainers 38 of one particular size are removed and replaced with retainers 38 of another particular size.

Such reconditioning and/or reconfiguring processes are performed in substantially the same manner and without the use of tools. Since the retainer 38 is secured in place by both the support member 34 and the mounting member 102, the support member 34 must be disengaged and removed from the mounting member 102 before the retainer 38 is disengaged from the support member 34.

More particularly, an operator would first depress the button 126 so that the button 126 disengages the aperture 142 in the support member 34. The operator may then disengage the support member 34 from the slot 122 in the mounting member 102.

After the support member 34 is cleared from the mounting member 102, the operator may move the retainer 38 out of abutment with the projections 86. To accomplish this, the operator grasps the base portion 50 of the retainer 38 and pulls it in the direction of the longitudinal axis 82 to move the retainer 38, specifically the intermediate portions 74, out of abutment with the projections 86. Alternatively, the operator can squeeze the distal ends 54 together and push the retainer 38 toward the projections 86.

To re-insert another retainer 38, the operator aligns the retainer 38 with the grooves 90 in the projections 86 and pushes the retainer 38 (by grasping the base portion 50, for example) such that the distal ends 54 and the arcuate portions 58 pass between the projections 86 before the intermediate portions 74 come into abutment with the projections 86. Next, the support member 34 is coupled to the mounting member 102. The operator depresses the button 126, and inserts the support member 34 into the slot 122 of the mounting member 102 until the button 126 snaps into and engages the aperture 142 in the support member 34. As the button 126 snaps into the aperture 142, the base portion 50 of the retainer 38 comes into abutment with the mounting member 102 to fully secure the retainer 38 in place on the support member 34.

When reconfiguring the container handling apparatuses 10 to accommodate different size bottles 18, a first retainer 38 having a first size is removed and replaced by a second retainer 38 having a second size. However, in

addition to the retainer 38, a first support member 34 may also be replaced by a second support member 34 having a recess 94 of a different size from the recess 94 of the first support member 34.

Fig. 6 illustrates another construction of a container handling apparatus 10′. The handling apparatus 10′ may be coupled to the conveyor 14 in a similar manner to the handling apparatus 10 of Fig. 1. The handling apparatus 10′ includes a support member 34′ coupled to the conveyor 14 and a one-piece, resilient retainer 38′ releasably coupled to the support member 34′. The support member 34′ and the retainer 38′ are similar to those shown in Figs. 1-5, with the differences being described below. Like portions are labeled with like reference numerals with prime (′) indicators.

The projections 86′ are configured much closer to each other on the support member 34′ as compared to the projections 86 on the support member 34 of Figs. 1-5. This allows the retainer 38′ to engage the grooves 90′ in the projections 86′ such that the projections 86′ are positioned inside the retainer 38′, rather than outside of the retainer 38′ as shown in Figs. 1-5. As shown in Fig. 6, the retainer 38′ is substantially engaged with the projections 86′ at the portions of the retainer 38′ defined by the blend radii 78′.

Fig. 7 illustrates the handling apparatus 10′ without an attached bottle 18 and Fig. 8 illustrates the handling apparatus 10′ with an attached bottle 18. The retainer 38′ is configured to be bent and resiliently biased in a direction toward the body 88′ of the support member 34′ (see Fig. 7).

As shown in Figs. 7 and 8, the retainer 38′ is angled downwardly at a location along the intermediate portions 74′ and near the projections 86′. The retainer 38′ is configured such that the smallest gap between the retainer 38′ and

the body 88′ of the support member 34′ occurs in the respective middle portions 66′, where the neck portion 22 of the bottle 18 is grasped. In the illustrated construction of Fig. 7, the smallest gap G_1 between the retainer 38′ and the body 88′ of the support member 34′ is about 1 mm. However, in other constructions of the handling apparatus 10′, the gap G_1 between the retainer 38′ and the body 88′ of the support member 34′ may be as large as about 2 mm.

From the location of the middle portions 66′ indicated by gap G_1, the remaining parts of the middle portions 66′, the forward portions 62′, and the distal ends 54′ are angled upwardly away from the body 88′ of the support member 34′ to facilitate entry of the collar 30 between the support member 34′ and the retainer 38′. Upon insertion of the neck portion 22 into the recess 94′ of the support member 34′ and into the arcuate portions 58′ of the retainer 38′, the retainer 38′ is upwardly deflected and biased downwardly against the collar 30 at the press point P (see Fig. 8). As a result, frictional forces are developed between the retainer 38′ and the collar 30 to substantially counteract disengagement of the bottle 18 from the support member 34′ and the retainer 38′.

With reference to Figs. 6-8, substantially the same procedure described above is used to couple and de-couple the support member 34′ and the mounting member 102′. However, since the retainer 38′ is engaged with the projections 86′ such that the projections 86′ are located inside of the retainer 38′, a different procedure must be used to couple and de-couple the retainer 38′ and the support member 34′. One coupling procedure, for example, may include positioning, or hooking one of the blend radii 78′ into the groove 90′ of one projection 86′, and grasping the opposite arm portion 42′ or 46′ to outwardly bend the retainer 38′ until the other blend radii 78′ is allowed to be positioned into the groove 90′ of

the other projection 86′ to couple the retainer 38′ and the support member 34′. Further, to de-couple the retainer 38′ and the support member 34′, one of the arm portions 42′ or 46′ may be grasped and bent outwardly until the corresponding blend radii 78′ is allowed to be removed from the groove 90′ of the corresponding projection 86′. The retainer 38′ may then be unhooked from the groove 90′ of the other projection 86′ to de-couple the retainer 38′ and the support member 34′.

Figs. 9 and 10 illustrate another construction of a retainer 38′′. Like portions of the retainer 38′′ of Figs. 9 and 10 are labeled with like reference numerals with double-prime (′′) indicators. The retainer 38′′ may be coupled to the support member 34 of Figs. 1-5, or the support member 34′ of Figs. 6-8. As shown in Fig. 9, the distal ends 54′′ of the retainer 38′′ extend further than the distal ends 54, 54′ and each define a shape having a radius to provide the bottle 18 a smooth transition into and out of engagement with the middle portions 66′′ of the retainer 38′′. Also, Fig. 10 illustrates the retainer 38′′ having a downwardly bent, non-planar profile similar to that of the retainer 38′ of Figs. 6-8.

The retainer 38′′ may be coupled and de-coupled with respect to the support member 34 or 34′ using any of the above or other procedures, depending upon how the retainer 38′′ is configured to be engaged with the projections 86 or 86′ of the support member 34 or 34′.

Various features of the invention are set forth in the following claims.